VAPOR INTRUSION MITIGATION: TRENDS & TECHNOLOGIES FOR BROWNFIELD REDEVELOPMENT

ENVIRONMENTAL SHOW OF THE SOUTH
MAY 17, 2018

Jordan Kleine, MPA
Southeast US District Manager

Land Science®
a division of REGENESIS®

INTRODUCTION

- Indiana University - School of Public & Environmental Affairs (SPEA)
  - Bachelors of Science (BS) & Masters of Public Affairs (MPA) in Environmental Management
- Southeast US District Manager for Land Science since September 2014
- Involved in the successful implementation of over **160** vapor mitigation systems throughout the Southeast US

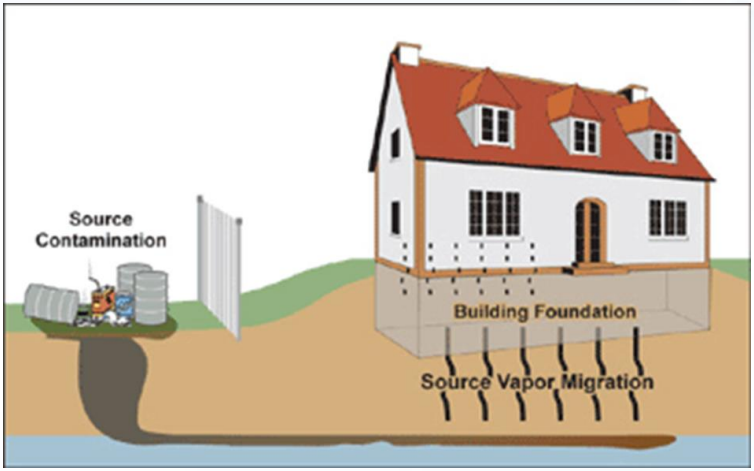
Land Science®
a division of REGENESIS®

TOPICS FOR DISCUSSION

Why Mitigate Vapor Intrusion?
Vapor Mitigation Options & Considerations
VMS Installation Processes

WHAT IS CONTAMINANT VAPOR INTRUSION?

Vapor intrusion (VI) is a process by which chemicals in soil or groundwater - especially Volatile Organic Compounds (VOCs) - migrate to indoor air above a contaminated site



WHY MITIGATE VAPOR INTRUSION?

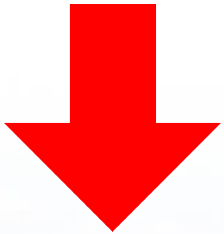
1. **Remediation alone may not protect VI risk**

   Levels might not be obtainable, cost, time constraints

WHY MITIGATE VAPOR INTRUSION?

2. **VI regulations & guidance are rapidly changing**

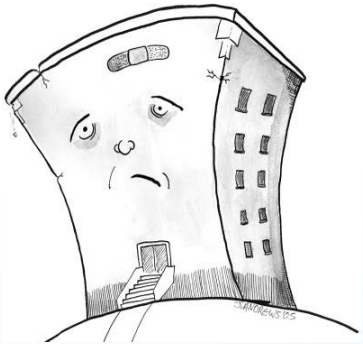
   Re-opening of sites, exposure levels are decreasing, VI added to scoring system for Superfund sites, nets are widening after USEPA update



WHY MITIGATE VAPOR INTRUSION?

3. Protect your/your client's investment

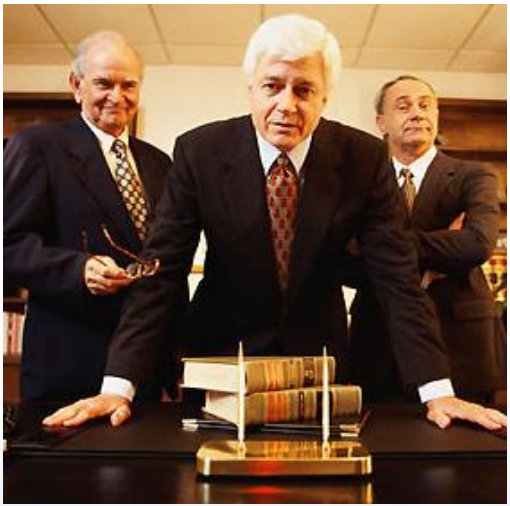
loss of financing, loss of property value, prevention of use



WHY MITIGATE VAPOR INTRUSION?

4. Avoid future legal liability

VI is driving lawsuits, due care expectation, toxic tort lawsuits, pre-emptive mitigation



PREEMPTIVE VAPOR MITIGATION

Pre-emptive vapor mitigation is often implemented at sites in which even a low potential exists for vapor intrusion

- Gaining traction with regulators, financial (lending) agencies, larger corporations.
- Reduces liability concerns
- Overall protective of property

COMMON VI MITIGATION OPTIONS

- Building Pressurization
- Void Spaces
- Active Venting or SSDS
- Passive Venting
- Vapor Mitigation Barriers

BUILDING PRESSURIZATION

Benefits

- Positive pressure keeps vapor out
- Fast interim solution
- HVAC modification

Considerations

- No protection when HVAC is off
- Cost effective?

VOID SPACE

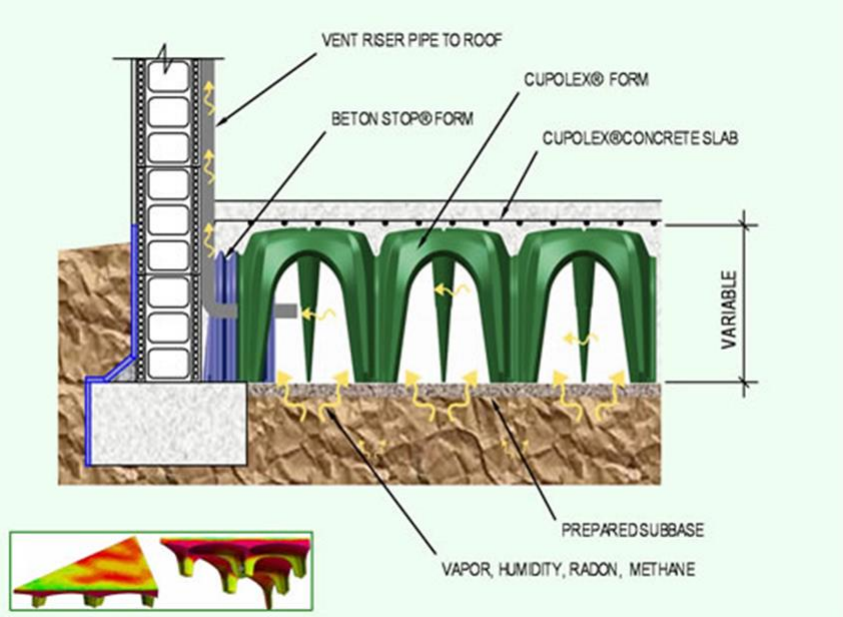
Benefits

- Built in crawl space
- Can reduce the amount of imported fill
- Can reduce the size of fan needed to vent vapors

VOID SPACE

Considerations

- Decision to mitigate needs to be made very early on
- Outside of GC's comfort zone
- Proven chemical resistance?
- Who installs these systems or makes repairs?



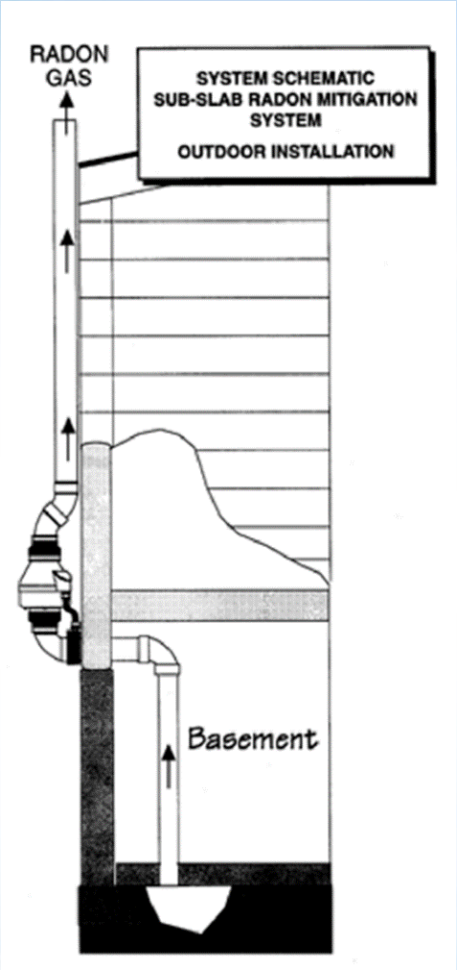
ACTIVE VENTING OR SSDS

Benefits

- Mechanical Removal of vapors
- Verifiable
- Real-time monitoring available
- Max protection when combined with vapor intrusion barrier

Considerations

- Long-term O&M
- Air permits required?
- Engineering Considerations
- Risk of mechanical failure, blackout, turned off.. Vapors drawn closer to slab



PASSIVE VENTING SYSTEMS

Benefits

- Equalizes pressure differential
- No long term O&M
- Easily activate in the future if needed

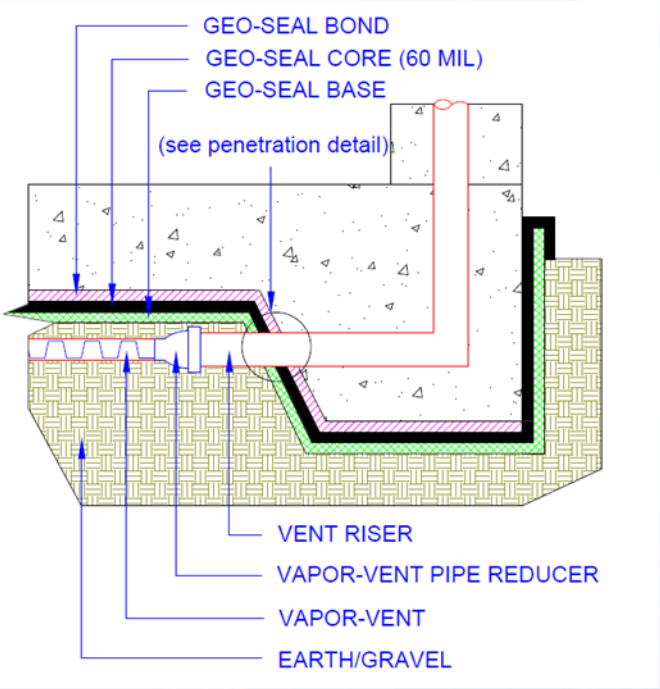
Considerations

- High contaminant concentrations may dictate SSDS
- Utilized with a vapor intrusion barrier

LOW PROFILE VENTING LAYOUT

Vapor-Vent™
Vapor Collection System

LOW-PROFILE VENTING CONNECTIONS



VAPOR INTRUSION BARRIERS

Considerations:

- Blocks VI pathway
- Often utilized with a vent system
- Not all barriers created equal

VI BARRIER SELECTION

- Chemical Resistance
- Constructability
- Quality Control

MOISTURE/“VAPOR” BARRIERS

Benefits

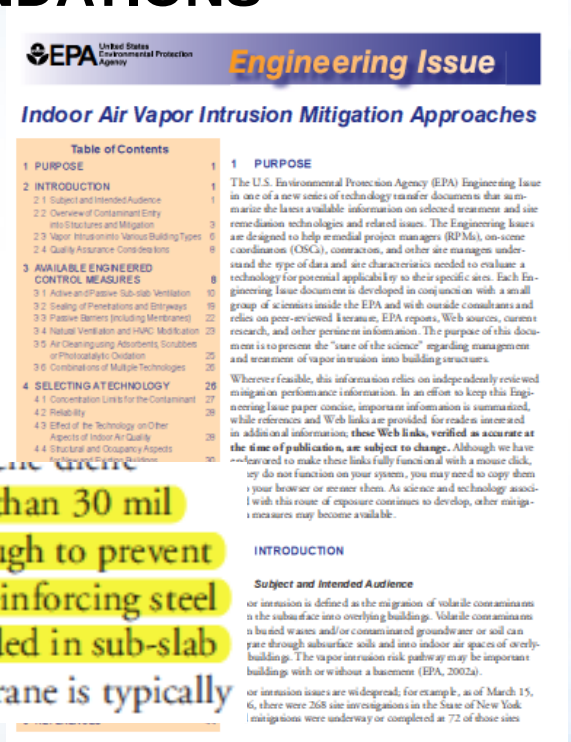
- Inexpensive Material
- Anyone can install it

Considerations

- Lack of Vapor Tightness
- Easily Damaged
- Not warranted for VI by manufacturer
- Not recommended by USEPA for VI

VAPOR INTRUSION BARRIER MINIMUM THICKNESS RECOMMENDATIONS

- USEPA – 40-60 mil
- NJDEP - 40 mil
- MASS - 40 - 60 mil
- ILEPA - 60 mil
- CA DTSC – 60 mil
- ITRC – 60-100 mil



EPA United States Environmental Protection Agency

Engineering Issue

Indoor Air Vapor Intrusion Mitigation Approaches

Table of Contents

1 PURPOSE

The U.S. Environmental Protection Agency (EPA) Engineering Issue in one of a new series of technology transfer documents that summarize the latest available information on selected treatment and site remediation technologies and related issues. The Engineering Issues are designed to help remedial project managers (RPMs), on-scene coordinators (OSCs), contractors, and other site managers understand the type of data and site characteristics needed to evaluate a technology for potential applicability to their specific sites. Each Engineering Issue document is developed in conjunction with a small group of scientists inside the EPA and with outside consultants and relies on peer-reviewed literature, EPA reports, Web sources, current research, and other pertinent information. The purpose of this document is to present the "state of the science" regarding management and treatment of vapor intrusion into building structures.

Wherever feasible, this information relies on independently reviewed mitigation performance information. In an effort to keep this Engineering Issue paper concise, important information is summarized, while references and Web links are provided for readers interested in additional information; **these Web links, verified as accurate at the time of publication, are subject to change.** Although we have endeavored to make these links fully functional with a mouse click, they do not function on your system, you may need to copy them to your browser or retype them. As science and technology associated with this route of exposure continues to develop, other mitigation measures may become available.

INTRODUCTION

Subject and Intended Audience

or intrusion is defined as the migration of volatile contaminants n the subsurface into overlying buildings. Volatile contaminants n buried wastes and/or contaminated groundwater or soil can pare through subsurface soils and into indoor air spaces of overly- buildings. The vapor intrusion risk pathway may be important buildings with or without a basement (EPA, 2002a).

or intrusion issues are widespread; for example, as of March 15, 6, there were 268 site investigations in the State of New York mitigations were underway or completed at 72 of those sites

monomer) rubber. Sheet membranes less than 30 mil (e.g., 6 mil visqueen) are not durable enough to prevent significant damage during placement of reinforcing steel and concrete and thus are not recommended in sub-slab applications. An example of how a membrane is typically

REGENESIS Land Science Technologies

HDPE GEOMEMBRANES

Benefits

- Great chemical resistance
- Rigid & Durable
    - 40-100mils
- Landfill applications

Considerations

- Batten and welded systems are labor intensive
- How to seal penetrations?
- Limited quality control

SIMPLE SPRAY-APPLIED MEMBRANES

Benefits

- Solves construction limitations of HDPE membranes
- methane mitigation

Considerations

- Sprayed onto geo-textile fabric
- VOC's can attack unprotected asphalt/latex

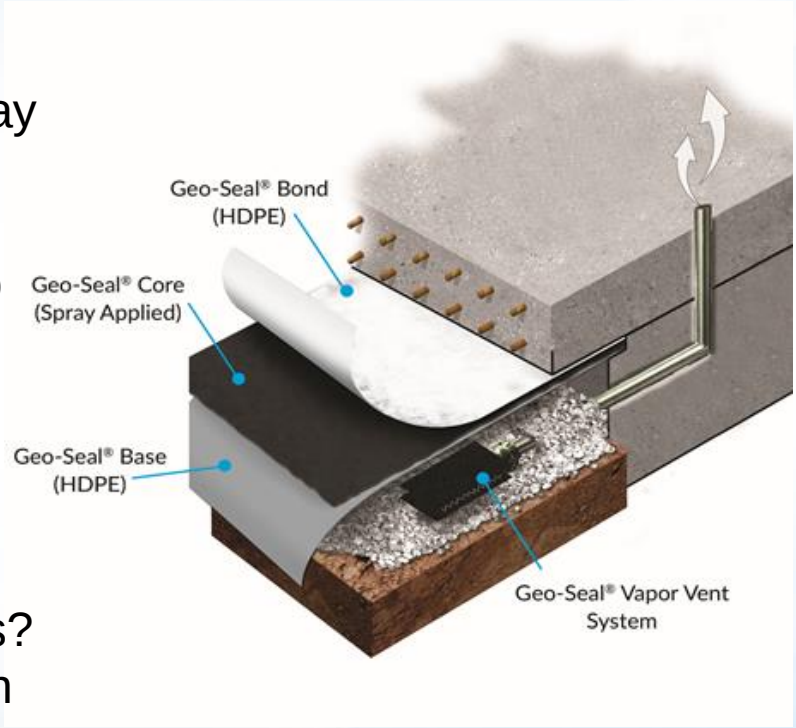
COMPOSITE MEMBRANES

Benefits

- Blends HDPE and spray membranes
- Easily Installed
- Chemically resistant to VOCs & cVOCs

Considerations

- Concrete protection needed
- Differential settlements?
    - Top layer selection



Geo-Seal®
Vapor Intrusion Barrier

COMPOSITE BARRIER INSTALLATION

Geo-Seal®
Vapor Intrusion Barrier

OVERLAP & SEAL SEAMS 6”

Geo-Seal
Vapor Intrusion Barrier

SEAL PENETRATIONS & PERIMETERS

Geo-Seal
Vapor Intrusion Barrier

TOP LAYER (BOND) INSTALLATION

Geo-Seal
Vapor Intrusion Barrier

QA/QC MEASURES

- Certified applicator
- Third Party Inspector
- Thickness verification
- Smoke testing
- Visual/Pre-Pour inspection

Geo-Seal®
Vapor Intrusion Barrier

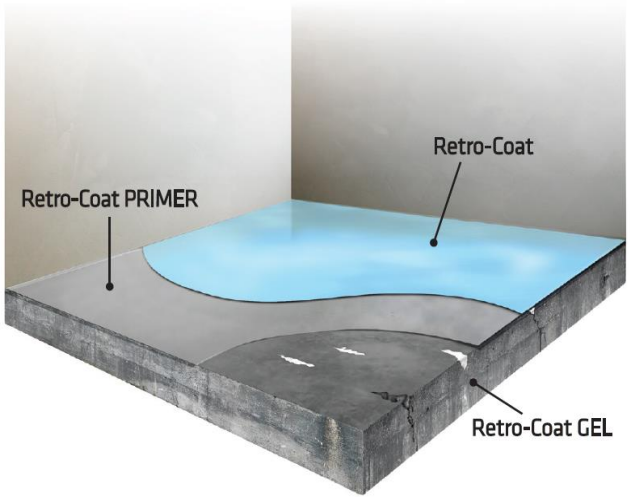
SMOKE TESTING

Retro-Coat™
Vapor Intrusion Coating

VAPOR INTRUSION COATING

Considerations:

- Wearing Surface
- Proven Chemical Resistance
- No VOCs in Formulation (No Off-gassing)
- Secondary Containment
- Aesthetics



Retro-Coat™
Vapor Intrusion Coating

VI COATINGS INSTALLATION PROCESS

- Certified Applicator Network of Coating Specialists
- Prepare surface (shot blasting, diamond grinding)
- Treat cracks, expansion joints, concrete repair
- Apply 6-20 mil Primer
  - based on Moisture Test (calcium chloride test)
- Apply 20 mil of VI Coating (for chemical resistance)
  - Optional: Top Coat Sealer (protects aesthetic/color from fading by UV)


MILACRON

IN CONCLUSION…

- Pre-emptive mitigation is gaining traction
- VI Mitigation helps manage long term liability and protect investments
- **Chemical resistance, constructability & quality control** measures are each important considerations when evaluating VI mitigation technologies

VAPOR BARRIER SYSTEM WITH A WARRANTY?

Land Science offers various material and system warranties* for Geo-Seal®

- **Material Warranty (30 years)**

  Warrants the integrity of the material (Geo-Seal, Retro-Coat, Vapor-Vent, etc.)

  OR
- **System Warranty (20 years)**

  Warrants the integrity of the material and the workmanship of the certified installer

**Provided on a site specific basis and requested prior to installation*

QUESTIONS?

Jordan Kleine

Jkleine@LandScienceTech.com

(470) 218 - 5728

www.LandScienceTech.com

Land Science®

a division of REGENESIS®